CHAPTER 12

Blockchain Beyond Crypto

As you are approaching the last pages of this book, I wanted to inspire you and help you see what's possible in the coming years from the blockchain technology. Crypto paved the way by providing an alternative to fiat currency with the introduction of bitcoin. Although the invention of bitcoin was more than a decade ago (it was introduced in 2008), blockchain is still in its infancy. However, it's poised to potentially become one the most useful technological innovations of the 21st century.

With that said, the road for technological integration and adoption by the masses is still long and bumpy, and blockchain has already experienced multiple ups and downs, driven by financial speculation, security, performance, trust, scalability, and regulation (not to mention crypto attacks from charlatans and hackers). These concerns have caused many to become skeptics. Despite all this, blockchain cannot be ignored. It has the potential to improve all industries and become as big of a globalized technological innovation as the Internet or the fax machine.

The potential of blockchain has been recognized by many, and in fact, in 2019 alone, companies are expected to invest more than $3 billion in blockchain technologies. By examining the current projects in development, the bigger picture shows that cryptocurrency is not the final frontier but just the beginning, because many blockchain projects are expanding beyond just cryptocurrency and disrupting more than just fiat currencies.

E. Elrom, *The Blockchain Developer*, https://doi.org/10.1007/978-1-4842-4847-8_12

In fact, many large corporations are incorporating blockchain technologies into their systems in one way or another. Hundreds of startups are slowly entering the mainstream, the potential utilization of blockchain technology seems limitless, and in many cases, blockchain opens up new potential revenue streams and new business models.

> *"We'll all look back in 20 years and conclude that bitcoin was an influential platform for innovation as the Internet itself was."*
>
> —Marc Andreessen

This chapter is broken into two parts. First I will cover how blockchain can be harnessed and expand on what's possible when utilizing elements of blockchain technologies. Then I will cover the decentralization of industries by discussing a few industries being disrupted by blockchain and by showing specific case studies.

Understanding the power and capabilities of blockchain technology and the technological innovations can give you insight into how you can harness the blockchain technological innovations for your own new greenfield project or an existing project and industry.

Harnessing Blockchain

Before discussing the decentralization of industries, let's quickly review the specific elements of blockchain that are readily available to implement now. Although I already covered everything in this section in previous chapters, here I will expand on these elements in the context of how they can be used in a project. I'll discuss the following:

- Coins
- Tokens

- Ledgers
- Smart contracts and dapps

These blockchain elements can then be used on their own, mashed together, or used as a hybrid of a blockchain and none-blockchain project to implement a unique application.

Coins

Blockchain technology started with bitcoin and expanded to more than 2,000 listed cryptocurrencies with a market cap of billions of dollars. Many of these coins listed through ICOs are not providing much value other than attempting to enrich the publishers and investors of these coins. However, the capabilities of creating coins and using blockchain as a cryptocurrency to make payments globally quickly and for low costs have inspired many. The crypto use cases highlight blockchain reliability as it's able to replace fiat currency.

> *"The future of money is digital currency."*
>
> —Bill Gates

At the time of writing, a large portion of the population in certain countries have heard of crypto, but it is not considered mainstream just yet. But in this section you'll see there are projects in the works that can push the usage of coins into mainstream use. For instance, in December 2018, media outlets reported that Facebook is developing a "stablecoin" for its WhatsApp users and is holding talks with exchanges about listing its stablecoin, which will be tied "to a basket of different foreign currencies, rather than just the dollar." Adoption by Facebook, which is used by a large portion of the population, will raise more awareness of crypto.

Note *Stablecoins* are crypto designed to minimize the volatility of price because they are tied to a more "stable" asset (or a basket of stable assets), such as a currency or exchange-traded commodities such as gold.

In addition, you saw examples of how coins themselves can offer more value than just the face value of the coin.

- *Bitcoin cash (BCH) colored coins*: These use the BCH protocol to create tokenized assets, which allows you to add tokens to BCH.
- *Bitcoin*: This uses bitcoin's `OP_RETURN` param to allow you to store data with the transaction.

These examples highlight the potential of coins as they can be used to transfer value more than just the digital currency.

Tokens

Cryptographic tokens are accounting units that can be used to represent the digital balance of a certain asset. For instance, bitcoin is a cryptographic token because it uses a digital signature in conjunction with ownership; however, not all cryptographic tokens are cryptocurrencies.

Tokens can be created with unique data and are called *nonfungible tokens* (NFTs) to represent something completely unique. These NFTs are not interchangeable as there is only one token with that exact data.

Note In contrast to crypto digital asset coins or many utility tokens that are fungible in nature, NFT is a special cryptographic token that represents something unique. These tokens are not interchangeable because they cannot be replaced.

Both NFT and utility tokens use a tokenization process that allows you to create a *security*. The security takes the digital asset and fractionalizes its ownership by creating digital tokens. Each token then represents a percentage of ownership in the asset. The use of blockchain makes the chain of custody and proof of ownership immutable, which gives an advantage to certain applications as the information cannot be altered like in a regular database.

Note Chain of custody in this context is the "paper trail" that records the sequence of transfer or analysis of the data.

In practice, this can be done with both digital assets and physical assets. For instance, the Kik messaging app (`https://www.kik.com`) turned its company into a digital asset and started selling tokens that represent a fraction of ownership in its company. Kik was able to raise $100 million that can now be used to grow its platform. What it has done is a reverse ICO; instead of raising funds prior to creating the company, it is selling a portion of the company after it's already up and running, just as a company can "go public" in the stock market.

Tip Keep in mind that there are many other industries, not mentioned in this chapter, that have the potential to gain by utilizing blockchain technology. I picked a few to get you inspired; however, you should do your own research to investigate and find more industries.

Additionally, tokens can take old ideas and revive them. For instance, some pay phones and trains used tokens; these token have no value other than the context of using them in a pay phone or the train station but not anywhere else. The dollar also used to be tied to the amount of gold that

the government kept in vaults, so when you held dollars prior to 1971, you used to own a token in the gold the U.S. government kept in its vaults. Similarly, today, stablecoin tokens represent fiat currency such as DAI, GUSD, TUSD, USDC, and USDT tokens created with the use of Ethereum. These tokens are based on companies placing fiat currency in an escrow account and registering their company with regulators.

Tokens can then represent any digital or physical value such as the following:

- Stocks
- Options
- Digital obligations
- Fiat currencies
- Ownership rights
- Rights for a service

Tokens can also combine a few assets. For instance, a token can represent a basket of different stocks or a basket of different fiat currencies.

The possibilities are unlimited, and as you have seen in previous chapters, there are many blockchains such as Ethereum, EOS, Hyperledger, and NEO that can provide an easy mechanism to create tokens.

Ledgers

A blockchain ledger can be used as a decentralized data storage for more than just crypto. Traditional cloud storage services are centralized, and you need to place your trust in a single entity with your valuable information or digital assets.

With blockchain, the data storage itself can become decentralized. P2P networks such as PirateBay, Limelight, and others have proven capable of stitching pieces of data together from different computers around the

globe to store digital assets such as video, music, images, and software. Although many of these P2P networks are in violation of copyright Material and considered illegal in many countries, a blockchain P2P network can share files by legitimate publishers while limiting access to authorized customers. Blockchain works in a similar way to these P2P networks and can be used to store any data. In fact, Storj (`https://storj.io/`) and Sai (`https://sia.tech`) are examples of cloud storages based on blockchain aimed at improving security, reducing costs, and decreasing dependency. Users can rent out their storage capacity when not in usage, creating a whole new marketplace that never existed.

Utilizing blockchain as decentralized data storage combined with other elements of blockchains such as coins and tokens can create interesting new possibilities.

Smart Contracts and Dapps

As you have seen, smart contracts are the programming of the cloud; they allow you to code against a blockchain. Smart contracts are created to be legally binding, programmable, digital documents. Just like traditional agreements, smart contracts create a set of rules to which two or more parties agree.

When the contractual obligations are met, funds can be automatically released, eliminating the need for a third party to be involved in the arrangement. Utilizing smart contracts for legal concerns can potentially become a better alternative to paper as they are stable, honest, and less prone to human errors. Using a smart contract, the middleman is not needed (middlemen can be attorneys, escrow agents, notaries, bankers, loan officers, and so on).

In this book, you created smart contracts on multiple blockchain platforms. Using these smart contracts, you were able to create a dapp's front-end interface to utilize the smart contract and publish the dapp.

In fact, companies are using smart contracts to automate many services. For instance, Slock.it created payments for renting usable devices; these devices can be any object such as bikes, cars, or even toolboxes. Similarly, Fizzy (https://fizzy.axa/) tracks flight delays and automatically refunds passengers when flights are delayed. These services are done automatically; you don't need to stand in lines or be passed along by phone representatives from one department to another. Additionally, these refunds can occur automatically. These contracts are saving the user and the businesses time, effort, and money. Additionally, customer service is improved, and as these services are automated, this can reduce the number of employees you need.

To summarize, in this section, I covered what's readily available from a business point of view that you can implement utilizing blockchain technology. I covered what you can do with coins beyond crypto, including using tokens to represent any value, using the blockchain ledger as a decentralized database, and writing code in the cloud utilizing smart contracts and dapps. By combining these elements, you get expedited services that are more reliable and cut out the middleman.

Decentralization of Industries and Verticals

In this section, I will show you examples from a few industries and how blockchain is utilized or can be utilized vertically and horizontally across different industries. The industries I am covering can serve as inspiration when implementing blockchain into an existing industry or for a new greenfield project.

Note In this context, *vertical* means specifically in a particular field, and *horizontal* can be adopted by everyone or any field.

I will be covering the following industries:

- Financial
- Cybersecurity
- Real estate
- Mobile
- Supply chain improvement
- Encrypted messaging platforms
- Elections and voting
- Marketing
- Healthcare
- Gaming

In today's world, many industries rely on one another, and there is much crossover between technology and brick-and-mortar businesses. For instance, real estate relies on the financial industry. The financial industry relies on security as there is a need to be able to verify documents and identities. Marketing relies on collecting data and forecasting. These crossovers and a mashup of services have the potential to create a seamless user experience that expedites the security, reliability, and globalization of blockchain; increases the speed of executing transactions; and offers lower costs to everyone involved.

Financial

In terms of the financial industry, you can split the actors into two groups: small financial groups and major financial institutions. Small financial groups can be startups, retailers, small banks, and individually owned companies. Major institutions include investment groups, large banks, and Fortune 500 companies.

Small financial groups have been experimenting with crypto and blockchain for years now. In regard to major financial institutions, it has been a love-hate relationship in regard to crypto; many financial CEOs and gurus have been criticizing crypto, with J.P. Morgan leading the way by calling any employee caught trading bitcoin "stupid" and with financial guru Warren Buffett calling bitcoin "delusion" and "attracts charlatans." However, when it comes to the blockchain technology itself, it's a different story. J.P. Morgan announced this year the creation of its own blockchain called Quorum and its own coin called JPM Coin.

Many other major financial companies are also starting to slowly warm up to the blockchain technology. Crypto exchanges have already passed through the Nasdaq's vetting process. NASDAQ, Citi, and Visa have invested $30 million in the blockchain-based startup Chain.com. NASDAQ also recognized Overstock.com's full support of a bitcoin payment option as well as the not-yet-published platform Roobee (https://roobee.io), an investment platform developed for retail investors.

In general, there are many areas in which both small and major financial groups can benefit from blockchain. I will be covering three: currency, infrastructure, and digital assets.

- *Currency:* This replaces fiat with crypto as an electronic cash system. Anyone can hold coins and pay quickly and inexpensive, cutting out the middle man (such as banks and credit cards). The current concerns around crypto replacing fiat currency are the volatility of price (because of the fluctuations of many coins), trust, and knowledge of how to create and accept a transfer and manage a wallet. These concerns can make many uneasy, especially ones who are not technology savvy. The large financial institutions can benefit from crypto by formalizing the transfer of crypto funds to the mainstream by creating their own cryptocurrency and/or accepting transfers of

existing crypto. Sure, there will probably be a fee involved as the middleman is getting involved again; however, crypto can potentially be used by the mainstream as a payment method just like other methods such as Visa, fiat currency, automated clearinghouses (ACHs), exchange-traded funds (ETFs), and so on. Users can then send funds around the globe while dealing with a trusted party. Here are some case studies:

- Coinpayments (`https://www.coinpayments.net`), BitPay (`https://bitpay.com/`), and Abra (`https://www.abra.com/`) are just a few examples of merchants that accept crypto payments.
- Bank-backed coins are another example. J.P. Morgan announced that the bank was starting a trial by transforming a trillion dollars that the bank lends to corporations to JPM Coin. This represents the first coin from a major bank.

- *Infrastructure*: Companies can replace existing infrastructure such as a centralized database with blockchain to replace to achieve better security and reduce costs. One of the concerns with a crypto transfer is that the user needs to understand what they are doing or risk losing funds. Here are some case studies:
  - *Transferring funds*: Western Union *is* testing Ripple (XRP) to see *whether it* can optimize the existing settlement system to expedit*e the* transfer of funds with blockchain. For the time being, Western Union claims it *has* not proved that *using* XRP can expedite transfers. "We tested with Mexico, one of our biggest corridors…*an*d with the efficiency that

we have currently, we didn't find the efficiency with Ripple yet," *according to* Western Union CEO Hikmet Ersek.

    - *Bookkeeping*: J.P. Morgan's Quorum blockchain (https://www.jpmorgan.com/global/Quorum) is being used by institutions to keep track of financial data.

- *Digital assets*: As I mentioned, blockchain can be used to create digital assets using tokens. These assets can be any financial vehicle. Here are some case studies:
    - *Chain (https://chain.com/)*: This offers what is called a *sequence*. It uses blockchain infrastructure to let organizations build financial services from the ground up with open source code on GitHub; see https://github.com/chain.
    - *Openchain (https://www.openchain.org)*: This is a startup focused on issuing and managing digital assets.
    - *Symbiont.io (https://symbiont.io/solutions)*: This brings mass adoption of blockchain to financial services. Additionally, NASDAQ has invested in Symbiont.io.

Cybersecurity

As you saw in the previous chapter when I covered security, phishing-malware and other hacker attacks aimed at identity theft have become a common practice. Many identity thefts are due to a hacker cracking a user's password. Instead of relying on a password to authenticate a user, blockchain has the potential to revolutionize digital identities by using cryptography to secure them. This is done by assigning each user private keys in the same way blockchain attaches private/public keys and then uses these keys to authenticate a user and find transactions that belong to a user.

In addition, verifying data can be an agonizing process and a major pain point for many people. Think about when you need to get a passport, notarize a document, or renew your driver's license. These processes involve a lot of effort and time. Blockchain can help ensure and verify the document's ownership and authenticity while expediting the time it takes, and you can do it all from the comfort of your home instead of waiting in a line or filling out a complex form.

These techniques can be applied to the following:

- Passports
- Digital identity
- Driver's license and ID
- E-residency
- Birth certificates
- Wedding/divorce certificates
- Notary of documents
- Online account login

Some use cases include the following:

- *Verifying identity*: Companies that offer blockchain IDs can be used to sign in on apps and web sites, digitally sign documents, and so on, reducing the risk of *identity theft*. Here are some case studies:
    - *Guardtime (https://guardtime.com)*: This is a blockchain company that has enhanced data authentication protocols by using Keyless Signature Infrastructure (KSI) transactions. The code either grants or denies access to the network based on the command received instead of a password. A prominent client of Guardtime is Verizon.

- *Keybase (https://keybase.io)*: Keybase holds an encryption key directory to map social media identities. Users can then use encrypt chat and cloud storage.
- *Onename (https://onename.com)*: This company provides you with an `.id` namespace on its Blockstack network.
- *ShoCard (https://shocard.com)*: This identity service is aimed at providing banks and financial institutions with a way to authenticate users.

– *Verifying data*: You can use blockchain to create a verifiable record of any data, file, business process, or just about anything on the blockchain. Here are some case studies:

- *Factom (https://www.factom.com)*: This provides a REST API to read, write, and search its Factom blockchain entries and platform, which includes SDKs, documentation, and a blockchain explorer to verify and debug entries.
- *Proof of Existence (https://proofofexistence.com)*: This company verifies the existence of files via the transaction's timestamped property.
- *Tierion (https://tierion.com)*: This is similar to Proof of Existence. Tierion offers proof and chainpoint. Chainpoint protects data by anchoring it to the bitcoin's blockchain, and the proof is using blockchain's timestamp property as a notary. This service is used by companies such as Dell and Xero. It also has a developer portal: https://chainpoint.org.

Real Estate

The real estate industry can potentially benefit from utilizing blockchain technology vertically and horizontally. If you have ever been involved in a real estate transaction, you know they are often complex and nontransparent and include a lot of paperwork and hard-to-follow moving pieces such as dealing with agents, property checks, deeds, financing, notaries, and in many cases attorneys. There are many pain points in the process. Blockchain can help reduce the costs, increase security, increase privacy, and expedite the process.

Combined with some of the elements discussed previously, these solutions can provide value such as identity, verify documents, and financial:

- Confirming identity
  - Securely identifying both buyer and sellers
  - Ensuring ownership
  - Keeping information private and on a need-to-know basis
- Verifying documents
  - Due diligence on property
- Conducting financial transactions
  - Transferring funds
  - Distributing funds between parties such as agents and sellers
  - Paying bills

Blockchain services addressing these elements can speed up the process and at the same time reduce paperwork and decrease costs.

Here are some case studies:

- *Harbor (https://goharbor.io)*: This provides an Ethereum ERC-20 token that allows for the resale of currency as security. It's a platform for digital securities such as funds, private equity, and commercial real estate.
- *Ubitquity (https://www.ubitquity.io)*: This offers a real estate SaaS platform utilizing the blockchain platform aimed at mortgage, title, and financial companies. It works with entities around the globe to gather property information and documents. Ubitquity offers an API for integration with its blockchain platform (https://www.ubitquity.io/).
- *Propy (https://propy.com/browse/)*: This company raised an ICO of more than $15 million and claims it can save people up to 25 percent in fees when buying property as well as avoid wire and fraud. Propy processes payments in any currency, including crypto.
- *Silentnotary (https://silentnotary.com), Dnote (www.dnote.online), and Blocknotary (https://www.blocknotary.com)*: These are just a few examples of companies that offer a decentralized notary. The concept is similar to Proof of Existence. The company verifies identity, and using blockchain's timestamp property it can verify documents. Blockchain captures the hash at a specific point in time, which can then be utilized to confirm the existence of something at that time. The timestamp can be used in a court of law and in the same way as a traditional notary. These services can eliminate the need for a physical notary. In fact, many states such as Arizona, Florida, Kentucky, Louisiana, Nebraska, and Nevada are already accepting e-notaries of deeds.

- *ShelterZoom (https://www.shelterzoom.com)*: This company is aimed at buyers, sellers, and renters. Sales are done using Ethereum's smart contracts.
- *StreetWire (http://www.streetwire.net/)*: This company tokenized physical real estate assets as well as providing data management services.

Mobile

Blockchain-based services can benefit users and help pain points related to mobile devices. Here are some examples:

- *Privacy*: Users around the globe are getting fed up with the lack of privacy as social media, telecommunications, and Internet companies are taking advantage of them by holding users' data and sharing the data for profit.
- *Dapps*: Supporting dapps can provide access to large numbers of new services without being censored by the mobile app's store.
- *Income*: Mobile phones can generate income via mining, leaving reviews for coins, etc., reducing the monthly bills for the user.

In fact, the mobile industry has recognized the potential and is harnessing blockchain to provide the user with more control, value, and privacy, with many big names making headlines this year.

> *"Telecommunications and Internet companies have derived tremendous value from controlling data. By decentralizing apps, we can put this data onto a smart contract, effectively giving control back to creators and to users," and "Much of what we call peer-to-peer or 'decentralized' services continue to be built upon centralized networks. We are changing that."*
>
> —Pundi X founder and CEO Zac Cheah

Here are some case studies:

- *Electroneum (https://electroneum.com/m1/)*: This is a new phone from a company called Electroneum. It has the following features:
  - *ETN cloud mining*: Users can mine up to $3 worth of ETN per month by running the cloud mining application.
  - *Low price*: It has a low price tag of $80.
  - *Hardware/software*: It is an Android device running version 8.1 Go, powered by a quad-core 1.3GHz CPU and supports 4G broadband cellular network technology and dual SIM cards.
- *HTC (https://www.htc.com/)*: This supports multiple dapps.
- *Pundi X (https://pundix.com)*: This company has redesigned its XPhone, estimated to be released for purchase in late 2019. It will include the following:
  - *Blockchain mode*: Services can operate independently of centralized carriers. Users can route phone calls, messages, and data via blockchain nodes without a centralized service provider.
  - *X button*: This allows users to switch to blockchain mode.
- *Samsung Galaxy S10 (https://www.samsung.com/us/mobile/galaxy-s10/)*: This includes the following:

- *Built-in crypto wallet*: This has private key storage with support for bitcoin, Ethereum, Cosmo Coin, and Enjin Coin, a gaming cryptocurrency.
- *Dapps*: It has out-of-the-box support for dapps.
- *Cosmo coin (COSM)*: It has support for the cosmo token, which powers the South Korean blockchain.
- *Earn coins*: Users can earn cosmo tokens in exchange for leaving reviews in the app.
- *Payment*: It has support for contactless payments with crypto.

Supply Chain

Companies can benefit greatly by utilizing blockchain as a private decentralized ledger to better store and use their own data globally. As you have seen, blockchain can store, monitor, and optimize data in an immutable and honest way that can be applied to supply chains. The supply chain can be broken down into these elements:

- *Chain of custody*: You can trace the chain of ownership of an asset.
- *Product identity*: You can store serial numbers or other product identification information on a blockchain allowing all parties (manufacturers, distributors, retailers, and consumers) to verify an item's authenticity. Keeping track of supply chains can help in many ways such as eliminating counterfeit products.
- *Monitor*: You can trace in real time supply chains, from raw Materials to a finished good.

Here are some case studies:

- *Blockverify (www.blockverify.io)*: This company uses blockchain for anticounterfeit measures by identifying counterfeits, preventing the duplication of products, and enabling companies to verify their products and monitor their supply chains.
- *British Airways (https://www.britishairways.com)*: This company uses blockchain to ensure that flight information is correct. It is also testing VChain (https://www.vchain.tech), a verification system to replace security checks.
- *Inxeption (https://www.inxeption.com)*: UPS has teamed up with the Inxeption platform to improve merchant supply chains.
- *Maersk (https://maersk.com/)*: The world's largest shipping company has teamed up with IBM to create a Hyperledger blockchain to monitor the cargo of ships.
- *Tracr (https://www.tracr.com)*: This is used by De Beers, the largest diamond producer utilizing blockchain technology, to create an immutable and permanent digital record for registered diamonds to cut down on conflict ("blood") diamonds.
- *Walmart*: This company is using blockchain to allow its employees to scan goods in the store's app and monitor the product from manufacturing to the store's floor.

Encrypted Messaging

In Chapter 1, I covered cryptography and how the Enigma machines were used to encrypt and decrypt messages in military communication. Blockchain is derived from messaging, and it can be used to send reliable encrypted messaging.

Blockchain can be used to update traditional solutions for end-to-end messaging encryption by leveraging a decentralization ledger to send messages anonymously and without a private user's data being sent, even masking the user's IP address.

Here are some case studies:

- *ADAMANT (https://adamant.im)*: This is an open source private messenger with a crypto payment option. See https://github.com/adamant-im.
- *Crypviser (https://crypviser.network)*: This is a private message platform.
- *Matrix (https://matrix.org/blog/home/)*: This is a chat ecosystem with open source code; see https://github.com/matrix-org/matrix.org.

Elections and Voting

Voting manipulation and electoral integrity are real problems; attackers have been known to use techniques such as Sybil attack to manipulate elections. Not surprisingly, many times there are recounts, accusations of fraud, and distrust as the whole process is often vague.

Voting requires the authentication of the voters' identities and secure record keeping, vote tracking, and tallying. Blockchain has the potential to revolutionize how voters cast their votes and could expedite the speed of completing this process in an honest and open way.

Blockchain tools could be used together as the infrastructure from start to finish. This could potentially eliminate the need for recounts and could build public trust in elections.

Voatz and Votem both point to a few potential advantages of utilizing blockchain for voting.

- *Verification*: Voters can verify that a vote was cast as intended and detect false results.
- *Transparency*: Governments and independent outside parties can confirm a vote's results as they are transparent when stored on a public blockchain.
- *Security*: Instead of one centralized computer on a traditional server system, voting data on the blockchain is distributed on many nodes, making it harder to alter results like when hacking into a single system.

Here are some case studies:

- *FollowMyVote (https://followmyvote.com)*: This is an election platform in beta.
- *Voatz (https://voatz.com/)*: This company wants to make voting safer and more accessible. It has already teamed up with the City of Denver and West Virginia to offer a mobile voting pilot.
- *Votem (https://votem.com)*: This voting platform is focused on mobile to secure votes in elections across the globe.

Marketing

Traditional analysts combine data from different sources in a nontransparent way and then use the data in many ways such as to monetize data, make a prediction, make businesses decisions, and so

on. However, if the data is false, the cost is high. False data gathering is estimated to cost more than $1 billion in losses every year.

As you have seen, the blockchain ledger can include other data with the transactions in a precise and immutable manner. The data can then be used to support planning, analysis, and forecasting, as well as follow supply chains. Data can be captured more accurately with a blockchain decentralized ledger because it reduces human error and data alteration. Once marketing data is captured, it can be analyzed by many industries such as entertainment, sports, music, and finance as well as by machine learning algorithms.

Using blockchain as an immutable database, where you can follow the chain of custody, is already is use in many of the blockchain industries covered in this chapter. In this section, I will highlight companies that focus on just the data aspect. The data can then be used for forecasting, leads, and decision-making.

Online advertisers rely on pay-per-click rates, followers on social media, and analytics, and it can become a challenging task to verify the accuracy of statistics and ensure companies are billed correctly for advertisements. There have been many tracking and measurement miscalculations, causing businesses to overpay. The reason for the miscalculations is that the traffic sent can come from bots, artificially bolstering stats, or fake followers in security attacks such as a Sybil attack. These miscalculations have resulted in billions of dollars in losses in the advertising industry.

Blockchain can record an encrypted and transparent chain of traffic (like chain of custody) to help determine whether the ads clicked and followers are coming from real audiences in a transparent way.

Additionally, blockchain can help connect brands with influencers and reach consumers easier by offering an agreement based on a smart contract and immediate crypto payment.

Here are some case studies:

- *AdChain (https://metax.io/en/products/adchain_registry/)*: This is a community-curated list of ad-supported web sites to provide advertisers with a stamp of approval on the web sites best suited for serving their ads.
- *Augur (https://www.augur.net)*: This is a prediction market protocol based on Ethereum, allowing users to forecast events. The platform incorporates a reward system for accurate predictions, enabling users to bet on everything including stocks, sports, presidential predictions, and more.
- *BOOSTO (https://boosto.io/)*: This is a decentralized app store, where brands can ensure that partners are reaching the consumers that the brand requests. Smart contracts are used for agreements, and payment are made once the terms decided on by the parties involved have been met utilizing its own crypto.
- *SWIPECrypto (https://www.swipecrypto.com/)*: This data monetization platform includes a privacy and data sharing protocol, as well as governance layers that reward data entry.
- *Wilbson (https://wibson.org)*: This allows users to sell their private information for profit, while protecting privacy.

Healthcare

There are many specific pain points in the healthcare industry that blockchain can help solve. For instance, just as with high-end brands, drug counterfeiting is a major problem in the pharmaceutical industry as 10 percent to 30 percent of all the drugs sold in developing countries are

counterfeit. These counterfeits amount to a loss to healthcare companies of billions of dollars. Most of the counterfeit drugs are manufactured in either India or China. Additionally, many of the counterfeit drugs contain the wrong ingredients or wrong dose, putting patients' health at risk.

Private blockchains controlled by a pharmaceutical company can register drugs and ensure that fake drugs get discovered as they won't be registered on their ledger.

According to Bisresearch, the blockchain market is expected to grow and reach more than $5 billion by 2025: https://bisresearch.com/industry-report/global-blockchain-in-healthcare-market-2025.html.

> *"A global blockchain in the healthcare market is expected grow at a CAGR of 63.85% from 2018 to 2025, to reach a value of $5.61 billion by 2025. The use of blockchain for healthcare data exchange will contribute the largest market share throughout the forecast period, reaching a value of $1.89 billion by 2025, owing to the use of blockchain to solve the most widespread problem in healthcare information systems related to interoperability and nonstandardization that has created data silos in the industry."*
>
> —Bisresearch

In addition, the healthcare industry can utilize blockchain to benefit from storing all kinds of important information about drugs as well as analyzing and processing information better.

- *Identifying patients*: Organizations such as CHIME and HIMSS have been pushing to create patient identity cards for almost two decades. The creation of a unique patient identifier can be easily solved with blockchain and ensure there are no mismatched patient electronic health records (EHRs), which leads to errors in patient care.

- *Tracing drugs*: As I mentioned, counterfeits can hold the wrong ingredients and cause harm to patients. Internet sales of counterfeit drugs account for $75 billion of the total market. Blockchain can be utilized to register all the authentic drugs' serial numbers.
- *Tracking drug results*: Blockchain can make it possible create a public ledger of patients to report the results of a specific drug. The system can validate that the user actually purchased the drug and the patient's condition. Using this data can provide valuable information to the pharmaceutical company or any related entity.

Here are some case studies:

- *Ambrosus (https://ambrosus.com/#mission)*: This blockchain system is aimed at following the chain of custody of clinical trials and pharmaceuticals. Food and pharmaceutical enterprises can use the platform to optimize supply chain visibility and QA.
- *ConnectingCare (https://www.simplyvitalhealth.com/)*: Here, patients and providers can share health data. It allows all kinds of unique applications, from calculating costs to the patient's ability to control their privacy to even allowing users to sell their data for research.
- *FarmaTrust (https://www.farmatrust.com)*: This is aimed at stopping counterfeit drugs with the usage of blockchain as a ledger.
- *Hashed Health (https://hashedhealth.com)*: This is aimed at solving credential problem by making data more transparent and easily accessible. The platform has a professional credentials exchange, where members can

verify the credentials of and track records of various health professionals. This can expedite the hiring process and provide an unalterable history of a professional's healthcare career history.

- *MedicalChain (https://medicalchain.com/en/)*: This enables patient–doctor interactions through the usage of blockchain. The project is funded through MedTokens. Patients have full access and control over their own personal health data and can grant doctors access to their health record via their mobile devices, while data is secure on the blockchain or via wristbands on patients, which medical professionals can scan to access a person's medical history if they are unconscious.
- *MedRec (https://medrec.media.mit.edu/)*: This provides EHRs on the blockchain via an Ethereum smart contract.
- *MTBC (https://www.mtbc.com)*: This is a large player aimed at improving EHR with the usage of blockchain. A patient will have the ability to allow the transfer of records from one doctor to another. The blockchain API runs on the Hyperledger platform.
- *Phros (https://phros.io/#home)*: This was released by Taipei Medical University Hospital and Digital Treasury Corporation (DTCO) to share health data while ensuring data privacy. The goal is to place all of a patient's medical information on the blockchain.
- *U.S. Department of Defense, U.S. Defense Logistics Agency*: These organizations are experimenting with a block-chain-based system that would allow data to be added

and tracked through a blockchain ledger, providing a live feed of multiple agencies' relief efforts in order to help save lives and reduce costs. See https://www.dla.mil/AboutDLA/News/NewsArticleView/Article/1720207/troop-support-event-poses-question-how-and-where-can-blockchain-help/.

Gaming

Games can benefit from blockchain by utilizing a blockchain ledger to store information as well as implement hybrid games that use a crypto marketplace for NFT transactions to purchase game-related items.

This usage of blockchain is already in motion. Sony is utilizing blockchain to record who owns what on the PlayStation Network. Fortnite creator Epic Games has partnered with a blockchain firm, Microsoft is using blockchain to handle Xbox Live royalty payments to developers, and many other companies are experimenting with blockchain usage.

Additionally, there is a Blockchain Game Alliance (BGA), which includes companies such as Ubisoft, ConsenSys, Everdreamsoft, and Enjin. The goal of BGA is to combine blockchain and gaming to develop solutions and develop standards and best practices.

Here are case studies:

- *Beyond the Void (https://beyond-the-void.net/)*: This is a game that utilizes Ethereum's blockchain to allow players to buy, sell, and trade "cosmetic in-game items" using NFT transactions.
- *Crypto card games*: These are similar to traditional card games, but instead of being physical cards, the cards are nonfungible. The cards are created using ERC-721 Ethereum tokens. Trading cards can be exchanged or played arcade-battle style. These cards can get expensive.

For instance, in 2018, CryptoKitties sold one cat for $111,000, and Gods Unchained sold a single card for $60,000. Examples are CryptoKitties (https://www.cryptokitties.co), Gods Unchained (https://godsunchained.com), and Spells of Genesis (https://spellsofgenesis.com).

- *HashCraft by Ubisoft*: This was built as an unreleased prototype that incorporates blockchain as the core gameplay, enabling players to be the builders of the game by utilizing a blockchain ledger as a database.
- *Plague Hunters (https://store.steampowered.com/app/746530/Plague_hunter/)*: This is a free-to-play strategy game with a built-in, Ethereum marketplace using NFT transactions for buying and selling weapons and "hunters." Plague Hunters passed Sony's review process and is scheduled to be released on PlayStation 4. It is the first blockchain-enabled game that provides NFT token trading on a major console.

In addition to these case studies, there is a dedicated web site just to keep track of advancements in blockchain technology related to games: https://blockchaingamer.net/. This resource can provide valuable information regarding current trends and news.

Music

In the current marketplace, many music industry artists, producers, fans, and consumers are frustrated, and blockchain has appeared to be a breath of fresh air to them because it has the potential to solve many pain points.

For instance, many artists and producers spend a lot of time and resources to infiltrate the market, publish work, and access the top music streaming platforms. Once an artist reaches the large streaming platforms such as Pandora, Spotify, and so on, they can access 250 million customers; however, many artists are unhappy with the payment structure and the time it takes to get paid. For instance, a song on Spotify would need more than 152,000 playbacks from premium users to be able to generate a mere revenue of $100 to the artist. The majority of the money goes to a long list of intermediary middlemen. Not only do artists get paid very little, it sometimes takes years to get these payouts.

By utilizing blockchain, artists can benefit in the following ways:

- *Increase the artist's revenues*: Blockchain can offer transparent and fair payouts. The content provider's revenue share can be split in a fair and transparent manner.
- *Streamline revenues*: Blockchain can provide a quicker way to pay artist royalties right away using crypto globally.
- *Split revenues automatically*: Smart contracts can be used to set up a payment structure for each individual involved in content creation such as songwriter.
- *Better connect with customers*: Fans can invest and connect with artists directly.
- *Store data*: Blockchain can be used to store information on the public ledger for digital right management (DRM), artists, assets, events, artists, venues, and so on.
- *Provide a streaming service*: A blockchain's P2P network can be used to stream music. Current music streaming services cost a lot or include too many ads.

The integration of music platforms needs to account for music formats and industry standards such as the following:

- *Common Works Registration (CWR) (www.cmrra.ca/)*: This is the standard format for registering and revising musical works.
- *DDEX (http://ddex.net)*: Provide a digital supply chain consortium by receiving data from leading media companies, music licensing organizations, digital service providers, and technical intermediaries and creating a standard.

Just like the gaming BGA Alliance, the music industry has created an organization to keep up with blockchain developments. The Open Music Initiative (open-music.org) explores the use of blockchain to help identify the rightful music rights holders and originators so they can modernize and streamline royalty payment and so artists can receive fair royalties. This can be done by utilizing blockchain for transparency and analyzing data better. Prominent members are Soundcloud, Red Bull Media and Netflix, Sony, YouTube, and Spotify.

Similar to hackathon competitions, Smackathon (https://www.smackathon.co) is an annual competition for interesting blockchain-based ideas in the music industry. For instance, in 2018, a blockchain platform was invented to pay listeners for every second they listened to a song, as well as providing fan engagement tools.

Looking at some of the more prominent projects, you will see that there are duplications of similar ideas. This reinforces how there are real pain points that need to be resolved in the music industry. The following are some case studies:

- *Audius (https://audius.co/)*: This uses a blockchain P2P network as a streaming service. Audius also uses blockchain for payment via smart contracts to send artists their payments immediately.

- *BitSong (https://bitsong.io/en)*: This company claims to be the first to use blockchain's P2P network for music streaming. Artists can upload songs and attach advertisements. For each advertisement listened to, the artist and the listeners get up to 90 percent of the profits that were invested by the advertiser. The platform includes a token called $BTSG to donate to indie artists and to purchase music.
- *Blokur (https://www.blokur.com)*: The Blokur platform combines AI and blockchain. Blockchain is used as the database to allow publishers to catalog their music, and then the community can approve or reject it. An AI algorithm resolves data conflicts automatically, such as rights disputes, to ensure the original artists get paid. There are already 50,000 songwriters and 7,000 publishers that have published their work.
- *Choon (https://choon.co)*: This uses blockchain for music streaming as well as digital payments to expedite the artists' payment. Artists can use Ethereum's smart contracts with each song to split the contributors' revenue. Other features are crowdfunding for new artists and rewards for users who create playlists.
- *eMusic (https://www.emusic.com)*: This uses blockchain and Ethereum smart contracts for music distribution of royalty payouts using a crypto token called eMusic.
- *Inmusik (https://inmusik.co)*: This has a crypto token called $OUND. Sounds are classified as "securitized music," and fans can "invest" in an artist to share earnings. Fans can also earn tokens for finding new songs, voting for best artists, and supporting the community. Artists can create an "army," get investors, and earn more than $20,000 per million streams.

- *MediaChain (www.mediachain.io)*: Acquired by Spotify, MediaChain utilizes blockchain's ledger for sharing information across different applications and organizations by issuing unique identifiers for each piece of information. MediaChain also works with artists to get them paid fairly using smart contracts.
- *Mycelia (myceliaformusic.org)*: This uses a blockchain ledger to hold a "creative passport," which contains information about a song, including IDs, acknowledgments, business partners, and payment mechanisms. Artists can create a smart contract payment system to split pay among all contributors.
- *MusicLife (https://www.musiclife.io)*: MusicLife created a media app called Echo (www.app-echo.com/index/download) with millions of users. The platform uses blockchain to process transactions quickly and do the bookkeeping. It created its own ecosystem and issued a token called $MITC. The algorithm allows an artist to claim music rights and get paid. Users can earn tokens as well as make purchases.
- *Musicoin (https://musicoin.org)*: This is a music blockchain streaming platform. Musicoin created a coin called $MUSIC to trade music-related purchases. Royalty earnings and tips go to artists immediately.
- *Ujo Music (https://www.ujomusic.com)*: This blockchain is used as a database to hold music ownership rights of an artist. Smart contracts and crypto are used to automate royalty payments to the artist and enable fans to tip artists directly. Artists can upload songs, control licensing, and manage distributions for free. Fans are charged a small fee of $1 for every 100 streams.

- *Viberate (https://www.viberate.com/fan)*: This uses a blockchain ledger. Viberate claims to be the world's largest live music database, which holds at the time of writing 460,000 artists and 500,000 events at 100,000 venues in 230 countries. Instead of hiring data entry people to keep insert and update artists, events, and venues, Viberate pays contributors with a $VIB crypto token.
- *VOISE (https://www.voise.com)*: This is a blockchain-powered app with an Ethereum token called $VOISE. Artists can upload content. Users' royalty pay goes almost entirely to the artists, cutting out the middleman.

Where to Go from Here

Blockchain already is in usage by many industries as well as has the potential to alter and improve many industries horizontally and vertically. I have covered only a few in this chapter; other industries include gambling, insurance, entertainment, and many others. I encourage you to do your own research regarding the relevant industry you are interested in as well as check the latest news, trends, and updates regarding current blockchain projects.

Summary

This book has been a journey into understanding blockchain technology. This chapter served as a 10,000-foot big picture of what's possible and I hope has inspired you on ways you can harness the blockchain technology.

As I pointed out, there are many use cases where replacing a centralized service with blockchain would not bring much value; however, there are many specific usages where blockchain platforms are benefiting industries already. Blockchain helps remove the long list of middlemen, closes the gap between users and entities, automates payments, improves data integrity, expedites services, globalizes transactions, improves security, lowers costs, and increases reliability.

In the first section of this chapter, I covered how to harness blockchain by examining what's readily available for you right now. I identified coins, tokens, ledgers, smart contracts, and dapps as the main elements that can be utilized to quickly tap into blockchain to potentially improve an existing platform. In the second part of this chapter, I covered many specific industries that can and have benefited from blockchain technology as well as listed case studies of specific blockchain-related ideas that being developed or have already been published.

Blockchain technology shows great promise, and the use cases, as well as the functionalities, are still unfolding. Over the next few years, blockchain usage is expected to increase and result in more widespread experimentation in many industries and verticals. Knowledgeable blockchain developers are believed to be a valuable commodity.

I would like to thank you, the reader, for purchasing this book and congratulate you for completing this chapter and this book. I hope that this book has provided you with valuable information, good coding examples, and a point of reference that will inspire you to create blockchain technology. Good luck in any new project you may take on.